## CONTENTS

Preface

Bibliography

(ca. 1927-1933)

CONT	ENTS OF THE SELECTED MATERIAL	
Part I		
Dirac T	Theory	3
1.1	Vibrating string [Q02p038]	3
1.2	A semiclassical theory for the electron [Q02p039]	4
	1.2.1 Relativistic dynamics	4
	1.2.2 Field equations	7
1.3	Quantization of the Dirac field [Q01p133]	22
1.4	Interacting Dirac fields [Q02p137]	25
	1.4.1 Dirac equation	25
	1.4.2 Maxwell equations	27
	1.4.3 Maxwell-Dirac theory	29
	1.4.3.1 Normal mode decomposition	31
	1.4.3.2 Particular representations of Dirac operators	32
1.5	Symmetrization [Q02p146]	35
1.6	Preliminaries for a Dirac equation in real terms [Q13p003]	35
	1.6.1 First formalism	36
	1.6.2 Second formalism	38
	1.6.3 Angular momentum	40
	1.6.4 Plane-wave expansion	44
	1.6.5 Real fields	45
	1.6.6 Interaction with an electromagnetic field	45

Table of contents of the complete set of Majorana's Quaderni

xiii

xxxvii

xliii

131

133

136

141

144 144

148

3.1.2.3 Third case

3.2

3.3

3.4

3.6

Wavefunctions of a two-electron atom [Q17p152]

2s terms for two-electron atoms [Q16p157b]

Energy levels for two-electron atoms [Q07p004]

3.6.1 Preliminaries for the X and Y terms

Self-consistent field in two-electron atoms [Q16p100]

Continuation: wavefunctions for the helium atom [Q05p156]

ix

151

155

157

158

159

169

170

174

175

176

183

184

184

185

190

191

195

197

201

204

205

211

219

223

224

225

227

229

233

233

237

238

239

242

243

244

245

246

251

251

254

Hyperfine structures and magnetic moments: calculations

[Q04p169]

3.22.1 First method

3.22.2 Second method

4.1.1 The equation for  $\sigma$ -electrons in elliptic coordinates

4.1.2 Evaluation of  $P_2$  for s-electrons: relation between W

Reduction of a three-fermion to a two-particle system [Q03p176] 282

261

261

261

263

275

275

278

287

287

288

289

300

307

311

311

316

317

318

319

321

324

327

 $\frac{328}{330}$ 

331

332

337

339

339

339

340

340

342

345

4.1

4.2

4.3

5.1

5.2

5.3

5.4

5.5

Part III

6.1

6.2

6.3

6.4

6.5

6.8

6.9

7.1

7.2

6.10

**Nuclear Physics** 

7.3.1

7.3.2

7.3.3

Molecular Physics

**Statistical Mechanics** 

The Theory of Scattering

The helium molecule [Q16p001]

4.2.1 The acetylene molecule

Vibration modes in molecules [Q06p031]

and  $\lambda$ 

4.1.3 Evaluation of  $P_1$ 

Degenerate gas [Q17p097]

Ferromagnetism [Q08p014]

Pauli paramagnetism [Q18p157]

Ferromagnetism: applications [Q08p046]

Scattering from a potential well [Q06p015]

6.6.1 Method of the particular solutions

Quasi coulombian scattering of particles [Q01p001]

Coulomb scattering: another regularization method [Q01p008]

Computation of the interaction potential between nu-

Simple perturbation method [Q06p024]

The Dirac method [Q01p106]

The Born method [Q01p109]

Compton effect [Q03p041]

Radioactivity [Q17p005]

cleons

Nuclear potential [Q17p006]

Nucleon density

Coulomb scattering [Q01p010]

Two-electron scattering [Q03p029]

Quasi-stationary states [Q03p103]

Appendix: Transforming a differential equation [Q03p035]

Wave equation for the neutron [Q17p129]

Mean nucleon potential

6.3.1 Coulomb field

Again on ferromagnetism [Q06p008]

CONTENTS		xi
	Nucleon interaction I	347 351

7.4 7.5 7.6	7.3.4 Nucleon interaction I 7.3.4.1 Zeroth approximation 7.3.5 Nucleon interaction II 7.3.5.1 Evaluation of some integrals 7.3.5.2 Zeroth approximation 7.3.6 Simple nuclei I 7.3.7 Simple nuclei II 7.3.7.1 Kinematics of two $\alpha$ particles (statistics) Thomson formula for $\beta$ particles in a medium [Q16p083] Systems with two fermions and one boson [Q17p090] Scalar field theory for nuclei? [Q02p086]	347 351 352 355 363 365 367 368 370 370
Part I	$\mathbf{V}$	
Classic	cal Physics	385
8.1	Surface waves in a liquid [Q12p054]	385
8.2	Thomson's method for the determination of $e/m$ [Q09p044]	387
8.3	Wien's method for the determination of $e/m$ (positive charges)	
0.0	[Q09p048b]	388
8.4	Determination of the electron charge [Q09p028]	390
	8.4.1 Townsend effect	390
	8.4.1.1 Ion recombination	390
	8.4.1.2 Ion diffusion	392
	8.4.1.3 Velocity in the electric field	393
	8.4.1.4 Charge of an ion	393
	8.4.2 Method of the electrolysis (Townsend)	394
	8.4.3 Zaliny's method for the ratio of the mobility coefficients	
	8.4.4 Thomson's method	395
	8.4.5 Wilson's method 8.4.6 Millikan's method	396
8.5	Electromagnetic and electrostatic mass of the electron	396
0.0	[Q09p048]	397
8.6	Thermionic effect [Q09p053]	397
	8.6.1 Langmuir Experiment on the effect of the electron cloud	
Mathe	matical Physics	403
9.1	Linear partial differential equations. Complete systems	
	$[\mathrm{Q}11\mathrm{p}087]$	403
	9.1.1 Linear operators	404
	9.1.2 Integrals of an ordinary differential system and the partial differential equation which determines them 9.1.3 Integrals of a total differential system and the associ-	405
	ated system of partial differential equation that deter-	
	mines them	406
9.2	Algebraic foundations of the tensor calculus [Q11p093]	409
	9.2.1 Covariant and contravariant vectors	409

Index

9.3		etrical introduction to the theory of differential quadratic I [Q11p094]	409
	9.3.1	The symbolic equation of parallelism	409
	9.3.2	Intrinsic equations of parallelism	409
	9.3.3	Christoffel's symbols	411
	9.3.4	Equations of parallelism in terms of covariant compo-	
	0.0.1	nents	412
	9.3.5	Some analytical verifications	413
	9.3.6	Permutability	414
	9.3.7	Line elements	414
	9.3.8	Euclidean manifolds. any $V_n$ can always be considered as immersed in a Euclidean space	415
	9.3.9	Angular metric	416
	9.3.10	Coordinate lines	417
	9.3.11	Differential equations of geodesics	418
	9.3.12	Application	420
9.4	Geome forms	etrical introduction to the theory of differential quadratic II [Q11p113]	422
	9.4.1	Geodesic curvature	422
	9.4.2	Vector displacement	422
	9.4.3	Autoparallelism of geodesics	424
	9.4.4	Associated vectors	424
	9.4.5	Remarks on the case of an indefinite $ds^2$	425
9.5	Covari	ant differentiation. Invariants and differential parame-	
	ters. L	Locally geodesic coordinates [Q11p119]	425
	9.5.1	Geodesic coordinates	425
	9.5.1.1	Applications	427
	9.5.2	Particular cases	429
	9.5.3	Applications	430
	9.5.4	Divergence of a vector	431
	9.5.5	Divergence of a double (contravariant) tensor	432
	9.5.6	Some laws of transformation	433
	9.5.7	arepsilon systems	434
	9.5.8	Vector product	435
	9.5.9	Extension of a field	435
	9.5.10	Curl of a vector in three dimensions	436
	9.5.11	Sections of a manifold. Geodesic manifolds	436
	9.5.12	Geodesic coordinates along a given line	437
9.6	Riema [Q11p1	nn's symbols and properties relating to curvature	441
	9.6.1	Cyclic displacement round an elementary parallelogram	441
	9.6.2	Fundamental properties of Riemann's symbols of the	
		second kind	443
	9.6.3	Fundamental properties and number of Riemann's sym-	
		bols of the first kind	444
	9.6.4	Bianchi identity and Ricci lemma	447
	9.6.5	Tangent geodesic coordinates around the point $P_0$	447

449